1/11/2015

سكشن [3] ميكانيكا موائع

AMR M.Y

(٩)

sheet - No. [9]

$$F = 3\pi \mu D V + \frac{9\pi}{16} \rho V^2 D^2$$

- D → sphere diameter.
- μ → viscosity.
- ρ → density.
- F → Drag Force.
- V → Velocity.

$$\mu = Pa.s = \frac{N.s}{m^2}$$

$$\frac{MLT^{-2} . T}{L^2} = ML^{-1}T^{-1}$$

$$MLT^{-2} = (3\pi) ML^{-1}T^{-1} . L . LT^{-1} + \frac{9\pi}{16} ML^{-3} . L^2T^{-2} . L^2$$

$$MLT^{-2} = (3\pi) MLT^{-2} + \left(\frac{9\pi}{16}\right) MLT^{-2}$$

∴ Function → is Homogenous

بشرط الثوابت ليس لها أبعاد

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sheet 2 - No. [13]

$S.G = 1.15$

what → ρ & γ → (SI)

solution

$$S.G = \frac{\rho}{\rho_{H_2O}} \qquad 1.15 = \frac{\rho}{1000} \qquad \rho = ... \; kg/m^3$$

$$\gamma = \rho * g = \square * 9.81 = ... \; N/m^3$$

b

No. 14

$\forall = 200\ ft^3$

weight = 10 520 lbf

find → γ, ρ

Solution

$$\gamma = \frac{weight}{\forall} = \frac{10\,520}{200} = \text{.....}\ lbf/ft^3$$

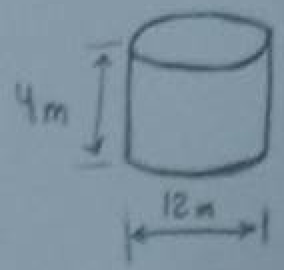
$$\gamma = \rho . g$$

$$\square = \text{-----} * 32.174$$

No. 15

$\rho_{w-20°c} = 1000\ kg/m^3$

$\rho_{w-50°c} = 985\ kg/m^3$



how much spill over

Solution

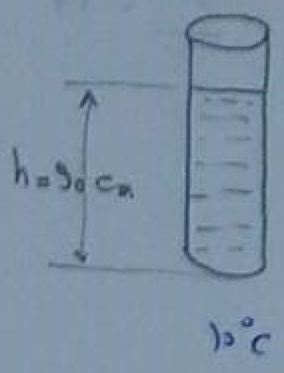
$$\forall_{20} = \frac{\pi}{4} (12)^2 * 4 = \square\ m^3$$

$$m = \rho_{20} * \forall_{20} = \rho_{50} * V_{50}$$

V_{50} → $\square$

so $V_{50} - V_{20} = \square$

No. 16



$V_{10} = 900\ ml = 900 * 10^{-6}\ m^3$

$h_{10} = 90\ cm = 90 * 10^{-2}\ m$

معامل تمدد الزجاج ← $\alpha = 3.6 * 10^{-6}\ C^{-1}$

$\rho_{10°C)_w} = 1000\ kg/m^3$

$\rho_{w)_{80°C}} = 971\ kg/m^3$

$$r_{80} = r_{10}\left[1 - (\alpha)(\Delta T)\right]$$

solution

$A_{10} = \frac{V_{10}}{h_{10}} = \frac{900 * 10^{-6}}{0.9} = \square\ m^3$

$A_{10} = \pi r_{10}^2 = \square \longrightarrow r_{10} = \text{W}\ m$

$r_{80} = r_{10}\left[1 + (3.6 * 10^{-6})(80 - 10)\right]$

$r_{80} = \text{W}\ m$

$A_{80} = \pi r_{80}^2 = \text{W}\ m^2$

$m = \rho_{10} * V_{10} = \rho_{80} * V_{80} = \text{W}$

$h_{80} = \frac{V_{80}}{A_{80}} = \square\ m$

d

No. 17

$\nu = 0.7 \frac{m^3}{kg}$

$\gamma = ??$

solution

$\gamma = \rho . g$

$\gamma = \frac{g}{\nu} = \frac{9.81}{0.7} = \square \ N/m^3$

No. 18 $\gamma = 16 \ N/m^3$ $\gamma_{air} = 12 \ N/m^3$

Find → $\rho = ??$, $\nu = ?$, $S.G = ?$,
↳ relativ to air

solution

$\gamma = \rho . g$

$16 = \rho * 9.81$ $\rho = \square \ kg/m^3$

$\nu = \frac{1}{\rho} = \frac{1}{\square} = ... \ m^3/kg$

$S.G = \frac{\gamma_{sub}}{\gamma_{air}} = \frac{16}{12} = \square$

(e)

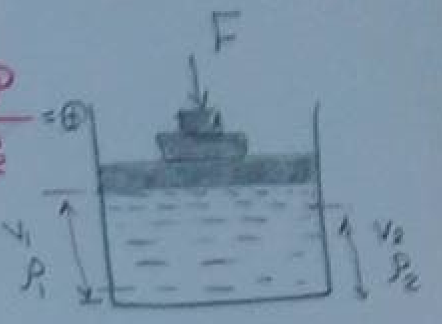
Bulk modulus of elasticity

$$B = K = E_V = \ominus \frac{\Delta P \oplus}{\frac{\Delta V}{V} \ominus} = -\frac{P_2 - P_1}{\left(\frac{V_2 - V_1}{V_1}\right)} = \frac{\Delta \rho}{\rho_2} = \oplus$$

increase in Pressure → ΔP

reduction in Voulme → $\frac{\Delta V}{V}$

K → وحدته وحدة ضغط



Percentage of reduction in volume . $\frac{\Delta V}{V}$

Percentage of reduction in specific volume $= \frac{\Delta \upsilon}{\upsilon} = \frac{\Delta V}{V}$

No. 19

$\frac{\Delta V}{V} = -0.02$ → reduce in volume.

$E_V = 320\,000$ Psi

Find → Pressure (Psi)

$P_{atmospher} = 0.0$

Solution

ضغط جوي

$$E_V = -\frac{P_2 - P_1}{\frac{\Delta V}{V}}$$

$P_1 \rightarrow 0$; $\frac{\Delta V}{V} = -0.02$; E_V ← 320 000 Psi

$P_2 = ..$ Psi

$P_2 = ---- * \frac{14.7}{0.1} = ----$ MPa

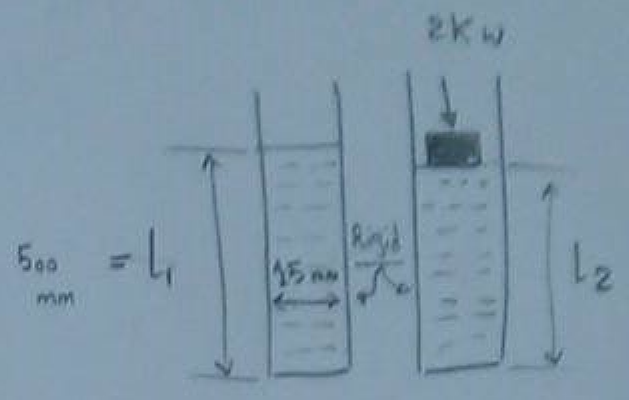
$0.1\ MPa = 1\ bar = 14.7\ Psi$

$\frac{0.1}{14.7}\ MPa = 1\ Psi$

F

No. 20

$L_2 = ??$ → $E_V = 320\,000$ Psi



solution

$$E_V = -\frac{\Delta P}{\frac{\Delta V}{V}}$$

320 000

$$\Delta P = \frac{F}{A} = \frac{2*10^3}{\frac{\pi}{4} * \left(\frac{15}{1000}\right)^2}$$

$\Delta P = \square$ Pa

→ $\Delta P = \frac{14.7}{10^5}$ PSI

$$\checkmark = \frac{\Delta V}{V} = \frac{V_2 - V_1}{V_1}$$

$$= \frac{AL_2 - AL_1}{AL_1} =$$

→ ∴ $L_2 = \checkmark$

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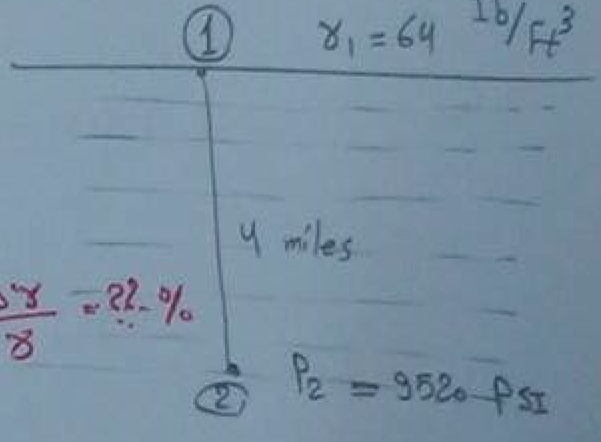
report

No. 21

$E_V = 320\,000$ PSI



(a) $\Delta V = V_2 - V_1 = ??$ (b) $V_2 = ??$

(c) $\gamma_2 = ??$ (d) $\frac{\Delta V}{V} = ??\%$ (e) $\frac{\Delta \gamma}{\gamma} = ??\%$

$$\checkmark E_V = -\frac{P_2 - P_1 \to 0}{\frac{\Delta V}{V_1}}$$ → (d)

solution

$$\gamma_1 = \frac{g}{V_1}$$ → ✓